NS A195: SPECIAL TOPICS IN SCIENCE - LUNAR EXPLORATION

Item	Value
Curriculum Committee Approval Date	10/06/2021
Top Code	191400 - Geology
Units	2 Total Units
Hours	72 Total Hours (Lecture Hours 18; Lab Hours 54)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Open Entry/Open Exit	No
Grading Policy	Standard Letter (S), • Pass/No Pass (B)

Course Description

Introduction to engineering design while building teamwork and communication skills and examining the engineering major offered and engineering careers. Completion of hands-on engineering design projects, preparation of short reports describing projects, and presentation of results. The specific project challenges students to explore a lunar lava tube with an eye toward its potential for human habitation. The overall goal is to build a rover and develop programs that allow an unmanned autonomous rover to navigate a model lunar lava tube. Transfer Credit: CSU.

Course Level Student Learning Outcome(s)

1. Identify, discuss and analyze current topics in lunar science.
2. Develop skills related to current lunar science.
3. Assess the limits of current engineering practices as they apply to lunar science and develop new strategies or directions for future practices.

Course Objectives

- 1. Identify, discuss and analyze current topics in lunar science.
- 2. Develop skills related to current lunar science.
- 3. Assess the limits of current engineering practices as they apply to lunar science and develop new strategies or directions for future practices.

Lecture Content

Introduction to Lunar Geology Why Study the Moon The Moon and Human History Pioneers in Lunar Geology Exploration of the Moon NASA s Exploration Strategy Geology Primer - The Stratigraphic Approach Training the Explorers (Astronauts) Impact Craters Cratering Mechanics Morphology Simple Complex Craters Multi-ring Impact Basins Apollo 11 Mission Tranquility Base The Terrae Origin of the Moon Giant Impact Model Early Lunar Crust Magma Ocean Basin Materials Orientale Basin Example Apollo 12 Mission Oceanus Procellarum The Maria Origin and Emplacement of the Maria Sinuous Rilles, Lava Flows, Volcanoes Tectonics: Straight Rilles Wrinkle Ridges Apollo 14 Mission Fra Mauro Geologic History of the Moon Superposition Relative Ages Crater Statistics Relative Ages Timescale: A Geologic History of the Moon Apollo 15 Mission Hadley Rille Origin of the Moon Early Models of Lunar Origin Giant Impact Theory for Lunar Origin Apollo 16 Mission Descartes Outposts on the Moon Why? Reasons to Return to the Moon How? Orion Capsule Heavy-Lift Vehicles When? Moonbases and Colonization Apollo 17 Mission Taurus Littrow

Lab Content

Introduction The RedBoard Platform Baseplate Assembly RedBoard Anatomy Breadboard Anatomy The Arduino IDE Inventory of Parts Light Blinking an LED Potentiometer Photoresistor RGB Night-Light Sound Buzzer Digital Trumpet Simon Says Game Motion Servo Motors Distance Sensor Motion Alarm Display : LCD Hello, World! Temperature Sensor DIY Who Am I? Game Robot Motor Basics Remote-Controlled Robot Autonomous Robot Going Further

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- DE Online Lecture (02X)
- Lab (04)
- DE Live Online Lab (04S)
- DE Online Lab (04X)

Instructional Techniques

Lectures, demonstrations, discussions, individual and small group exercises, instructor feedback, peer-to-peer.

Reading Assignments

Students will spend approximately 2 hours reading from the textbook and instructor material provided via LMS.

Writing Assignments

Students will spend approximately 1 hour per week on writing assignments, including: Keeping a journal of chronological notes taken during research, lecture, and laboratory experience. Author a technical report for each project written to industry standards for technical reports.

Out-of-class Assignments

Students will spend approximately 3 hours per week on out-of-class assignments, including: Researching topics as assigned. Preparing technical documents prior to laboratory projects. Completing technical reports after each project. Maintaining a portfolio of projects throughout the semester.

Demonstration of Critical Thinking

Students execute the design of a robot using the engineering design process. Students work individually and in groups to solve challenges presented in a project-based form. Quizzes are administered at the end of each topic to demonstrate mastery of the specific objective. Midterm and a final exam administered to test the ability to retain problem-solving skills.

Required Writing, Problem Solving, Skills Demonstration

Exercises Group and individual Projects Quizzes Midterm Exam Final Exam Keep a journal of chronological notes taken during: a) research b)

lecture c) laboratory experience. Maintain a portfolio of technical reports, research and class notes. Submit technical reports for lab projects containing results and analysis.

Eligible Disciplines

Earth science: Master's degree in geology, geophysics, earth sciences, meteorology, oceanography, or paleontology OR bachelor's degree in geology AND master's degree in geography, physics, or geochemistry OR the equivalent. Master's degree required. Robotics (computer integrated manufacturing): Any bachelor's degree and two years of professional experience, or any associate degree and six years of professional experience.

Textbooks Resources

1. Required Spudis, Paul. The Value of the Moon: How to Explore, Live, and Prosper in Space Using the Moon's Resources, 1st ed. Smithsonian Books, 2016 Rationale: * 2. Required Wilhelm, D. E.. Geologic History of the Moon, 1st ed. CreateSpace Independent Publishing Platform , 2014 Rationale: *

Software Resources

1. SparkFun Inventors Kit. SparkFun, 4.1 ed. This is the best method for navigating beginning embedded electronics. This kit contains all the information you will need to build five projects encompassing the 16 circuits of the SIK for the SparkFun RedBoard